STS 131 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-131) and International Space Station (19A)

Space Shuttle: The toxicological assessments of 1 grab sample canister (GSC) from the Shuttle are reported in Table 1. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (^{13}C-acetone, fluorobenzene, and chlorobenzene) from the Shuttle GSC were 100%, 93%, and 101%, respectively. Based on the historical experience using end-of-mission samples, the Shuttle atmosphere was acceptable for human respiration.

Table 1. Analytical Summary of Shuttle Samples

Sample Location	Date of Sample	NMVOCs [a] (mg/m^3)	Freon 218 (mg/m^3)	T Value[b] (units)	Alcohols (mg/m^3)	Formaldehyde ($\mu g/m^3$)
Preflight	4/05/10	0.3	--	0.37	0.20	--
Mid-deck (end of mission)	Unsuitable sample	--	--	--	--	--
Guideline		*25*	*none*	*1.0*	*none*[c]	*<120*

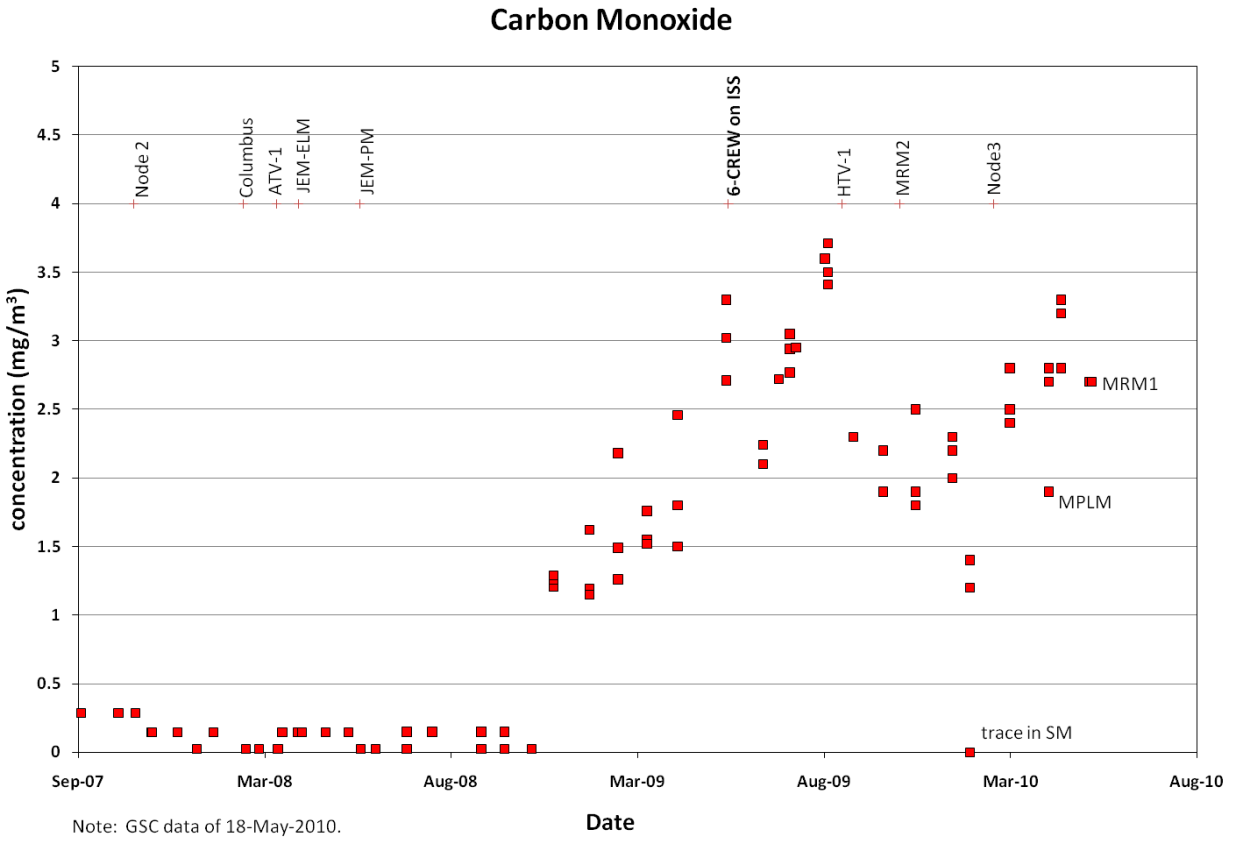
[a] Non-methane volatile organic hydrocarbons, excluding Freon 218
[b] Based on 7-day SMACs and calculated excluding CO_2, formaldehyde, and siloxanes.
[c] There is no guideline value because water is not recovered from humidity condensate on Shuttle as it is on ISS.

International Space Station: The toxicological assessment of 7 GSCs from the ISS is shown in Table 2. The recoveries of the 3 standards (as listed above) from the GSCs averaged 62, 87 and 73%, respectively. Concentrations of compounds were corrected for the low recoveries. Recovery from formaldehyde control badges ranged from 90 to 112%.

Table 2. Analytical Summary of ISS Results

Module/ Sample	Date of Sample	NMVOCs[a] (mg/m^3)	Freon 218 (mg/m^3)	T Value[b] (units)	Alcohols (mg/m^3)	Formaldehyde ($\mu g/m^3$)		
SM	3/01/10	10	98	**1.12**[c]	5.7	date	SM	Lab
Lab	3/01/10	9	87	**1.16**[c]	5.5	11/29/09	22	35
JEM	3/01/10	11	95	**1.17**[c]	**6.1**[c]	1/4/10	26	44
Columbus	4/08/10	6	92	0.36	3.5	1/21/10	25	33
Lab	4/08/10	6	90	0.35	3.5	3/1/10	--	30
SM	4/08/10	7	94	0.42	4.2	4/16/10	23	27
MPLM (first entry)	4/08/10	17	7[d]	2.88	3.2	4/20/10	46	35
Guideline		*<25*	*none*	*<1.0*	*<5*	*<120*		

[a] Non-methane volatile organic hydrocarbons, excluding Freon 218
[b] Based on 180-d SMACs and calculated excluding CO_2, formaldehyde, and siloxanes.
[c] Higher T value is due to traces of propenal, a mucosal irritant. High alcohol is due to ethanol.
[d] The relatively low value for Freon 218 suggests that capture of the first-entry sample was immediately after hatch opening.



Carbon Monoxide Accumulation aboard ISS: From late 2008 the nominal concentrations of CO had been increasing gradually (see figure above). The results from samples returned on this flight and STS-132 indicate that the CO concentrations, after dropping in late 2009, have cycled upward. In any case, these changes are well below the 180-day SMAC for CO, which is17 mg/m^3. There is no threat to crew health. The source of the additional CO is unknown.

General Observations about ISS Air Quality:

This is a very limited set of samples on which to perform an air quality assessment. However, based on these samples, we have no reason to believe that nominal ISS air is unsafe to breathe. Past observations of sporadic traces of propenal have recurred, but at a lower level. We must continue to be vigilant when dealing with nominal atmospheres in ISS. New, unmanned modules, such as the MPLM, require special attention when the crew first enters.

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Enclosures

Table 1A: Analytical concentrations of compounds found in the STS-131 GSCs
Table 1B: Analytical concentrations of compounds found in 19A GSCs
Table 2A: T-values of the compounds in table 1A
Table 2B: T-values of the compounds in table 1B